

REMARKS

When the present Office Action was mailed (September 2, 2004), claims 50-83 were pending, with claims 56, 75, and 78-83 withdrawn. Claims 50, 57, and 68 have been amended to clarify certain aspects of these claims. Claim 65 has been rewritten in independent form and amended to clarify certain aspects of this claim. Claims 64, 66, and 67 have been amended solely to change their dependencies. Claim 63 has been cancelled. Accordingly, claims 50-62 and 64-83 are currently pending, with claims 56, 75, and 78-83 withdrawn.

In the Office Action mailed September 2, 2004, claims 50-55, 57-74, 76, and 77 were rejected and portions of the application were objected to. More specifically, the status of the application in light of this Office Action is as follows:

- (A) The title of the application was objected to;
- (B) The specification was objected to;
- (C) Claims 50, 51, 53, 55, 57-59, 62-64, 67-69, 72, 73, and 77 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,784,023 to Ball ("Ball");
- (D) Claims 50-55, 57-62, 68, 70-74, 76, and 77 were rejected under 35 U.S.C. § 102(b) as being anticipated by Venkateshwaran et al. ("Venkateshwaran"); and
- (E) Claims 50-53, 55, 57-60, 62-70, 72, 73, 76, and 77 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,157,080 to Tamaki et al. ("Tamaki").

The undersigned attorney wishes to thank the Examiner for engaging in a telephone conference on December 2, 2004. During the telephone conference, the Examiner and the undersigned attorney discussed the present Office Action, the applied references, and the pending claims. The following remarks summarize and expand upon the points discussed during the December 2 telephone conference.

As a preliminary matter, the present Office Action incorrectly indicated that claims 50-55, 57-62, 68, 70-74, 76, and 77 were rejected under 35 U.S.C. § 102(b) as being anticipated by Venkateshwaran. During the December 2 telephone conference, however, the Examiner noted that the rejection of claims 50-55, 57-62, 68, 70-74, 76, and 77 over Venkateshwaran should be a Section 103 rejection rather than a Section 102(b) rejection. Accordingly, the arguments presented below treat this rejection as a Section 103 rejection.

A. Response to the Title Objection

The title of the application was objected to as failing to be descriptive. The title of the application has been amended in this response. Therefore, the objection to the title should be withdrawn.

B. Response to the Objection to the Specification

The specification was objected to because the cross-reference to U.S. Patent Application No. 09/644,766 was not updated to include a corresponding reference to the patent issuing from this application. The specification has been updated to include the appropriate patent number and, accordingly, the objection to the specification should be withdrawn.

C. Response to the Section 103 Rejection of Claims 50, 51, 53, 55, 57-59, 62-64, 67-69, 72, 73, and 77 (Ball)

Claims 50, 51, 53, 55, 57-59, 62-64, 67-69, 72, 73, and 77 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ball. Claim 63 has been cancelled, therefore the rejection of this claim is now moot.

To establish a *prima facie* case of obviousness, the prior art reference must teach or suggest all the claimed features. (MPEP § 706.02(j); emphasis added.) As set forth in detail below, the applied reference cannot support a § 103 rejection of claims 50, 51, 53, 55, 57-59, 62-64, 67-69, 72, 73, and 77 for at least the reason that this reference fails to teach or suggest all the claimed features.

1. Independent Claim 50 Includes, *Inter Alia*, a First Packaged Microelectronic Device Connected to a Support Member and/or Support Member Circuitry, and a Second Packaged Microelectronic Device Connected the Support Member and/or Support Member Circuitry Without Being Fixedly Attached to the First Packaged Device

Independent claim 50, as amended, is directed to an assembly of packaged microelectronic devices. The assembly includes a support member having support member circuitry. The assembly further includes a "first packaged microelectronic device" with "a first microelectronic die generally encased in a first encapsulant to define a first package configuration." The first packaged microelectronic device is "connected to at least one of the support member and the support member circuitry." The assembly also includes a second packaged microelectronic device "connected to at least one of the support member and the support member circuitry with the first packaged microelectronic device positioned between the support member and the second packaged microelectronic device." The second packaged microelectronic device includes "a second microelectronic die generally encased in a second encapsulant to define a second package configuration different than the first package configuration." The second packaged microelectronic device is not fixedly attached to the first packaged microelectronic device. Accordingly, an advantage of a device assembly configured in accordance with claim 50 is that the second packaged device can be separately removed from the support member and replaced (if necessary) without adversely affecting the first packaged device.

2. Ball Discloses a Multi-Chip Die Assembly Having a Lower Die and an Upper Die in a Stacked Die Arrangement

Ball discloses a multi-chip die assembly having a pair of stacked dies. Referring to Figure 6, for example, Ball teaches an upper die 602 and a corresponding lower die 604 that is connected to a leadframe or other substrate 606. The upper and lower dies 602 and 604 appear to have the same planform shape and each die "contain[s] identical integrated circuitry . . ." (Ball, col. 6, Ins. 10-11.) Ball further teaches that "a back side 622 of the upper die 602 is adhered to a lower die 604 with a layer of adhesive 618 applied over a lower die back side 620." (Ball, col. 7, Ins. 29-32.) An

underfill compound 632 is disposed between the lower die 604 and the substrate 606 to more firmly secure the lower die 604 to the substrate 606 and to protect the electrical connections between the lower die 604 and the substrate 606.

It should be noted that the characterizations herein of Ball are specifically limited to the specification and in no way construe and/or limit Ball's claims.

3. Claim 50 is Patentable over Ball Because this Reference Fails to Teach or Suggest Several Claimed Features

Claim 50 teaches that "the second packaged microelectronic device is not fixedly attached to the first packaged microelectronic device." In contrast, Ball discloses that the upper die 602 is adhered to the lower die 604 with a layer of adhesive 618. Moreover, it would not be obvious to modify Ball in accordance with claim 50 such that the upper die 602 is "not fixedly attached" to the lower die 604. Ball is directed toward increasing integrated circuit density and thus, spacing the upper and lower dies 602 and 604 apart would obviate one of the teachings of Ball. Accordingly, Ball cannot support a rejection of claim 50 because this reference fails to teach or suggest not fixedly attaching the second packaged device to the first packaged device. Therefore, the Section 103 rejection of claim 50 should be withdrawn.

Claims 51, 53, and 54-56 depend from claim 50. Therefore, the Section 103 rejections of these dependent claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

Independent claims 68 and 73 include several features generally similar to claim 50 (e.g., the second packaged microelectronic device not being fixedly attached to the first packaged microelectronic device.) Accordingly, for the reasons discussed above and for the additional features of these claims, the Section 103 rejections of claims 68 and 73 are unsupported by Ball and should be withdrawn.

Claims 69 and 72 depend from base claim 68, and claim 77 depends from base claim 73. Therefore, the Section 103 rejections of claims 69, 72, and 77 should be withdrawn for the reasons discussed above and for the additional features of these dependent claims.

4. Independent Claim 57 Includes, *Inter Alia*, a First Packaged Microelectronic Device Generally Encased in a First Encapsulant and a Second Packaged Microelectronic Device Generally Encased in a Second Encapsulant

Independent claim 57, as amended, is directed to an assembly of packaged microelectronic devices. The assembly includes a support member and a first packaged microelectronic device connected to the support member. The first microelectronic device includes "a first microelectronic die generally encased in a first encapsulant to define a first planform shape." The assembly also includes a second packaged microelectronic device connected to the support member with the first packaged microelectronic device positioned between the support member and the second packaged microelectronic device. The second packaged microelectronic device "includes "a second microelectronic die generally encased in a second encapsulant to define a second planform shape different than the first planform shape."

5. Claim 57 is Patentable Over Ball Because the Applied Reference Fails to Teach or Suggest a First and a Second Encapsulant

Claim 57 is patentable over Ball because the applied reference fails to teach or suggest "a first microelectronic die generally encased in a first encapsulant to define a first planform shape" and "a second microelectronic die generally encased in a second encapsulant to define a second planform shape different than the first planform shape." As mentioned above, it appears from Ball's drawings and specification that the upper and lower dies 602 and 604 have identical planform shapes. Furthermore, Ball does not appear to explicitly suggest upper and lower dies 602 and 604 having different planform shapes. Accordingly, the Section 103 rejection of claim 57 should be withdrawn.

Claims 58, 59, and 62 depend from claim 57. Therefore, the Section 103 rejections of these dependent claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

Claims 64 and 67 have been amended to depend from claim 65. As discussed below, claim 65 is now allowable and, therefore, the Section 103 rejection of claims 64 and 67 should be withdrawn.

D. Response to the Section 103 Rejection of Claims 50-55, 57-62, 68, 70-74, 76, and 77 (Venkateshwaran)

Claims 50-55, 57-62, 68, 70-74, 76, and 77 were rejected under 35 U.S.C. § 103 as being anticipated by Venkateshwaran. As discussed above, this rejection should be a Section 103 rejection, rather than the Section 102(b) rejection listed in the Office Action. For the reasons explained below, however, the Section 103 rejection of these claims is not proper because Venkateshwaran fails to teach or suggest all of the claimed features.

1. Venkateshwaran Discloses a Stacked Multi-Chip Die Assembly Including a Plurality of Dies Attached to a Substrate

Referring to Figure 6, Venkateshwaran discloses a stacked multi-chip assembly having a substrate 610 with a flip-chip assemblage having a larger die 401 positioned over a smaller flip-chip die 402. A plurality of bump terminals 411 are located around the perimeter of larger die 401 and provide stand-off clearance between the active surface of die 401 and the backside of die 402 after all of the terminals 411 have been connected to the substrate 610. An underfill material 410 “surrounds the smaller dice, contacts the active surface of the larger die, and thereby provides a thermal path to the outside of the package for each integrated circuit.” (Venkateshwaran, col. 4, Ins. 54-57.)

2. Claim 50 is Patentable Over Venkateshwaran Because the Applied Reference Fails to Teach or Suggest Several Claimed Features

As discussed previously, claim 50 includes a second packaged microelectronic device not fixedly attached to a first packaged microelectronic device. Accordingly, the first and second packaged microelectronic devices are individually separable from the support member. In contrast, the multi-chip assembly of Venkateshwaran includes both dies 401 and 402 attached to the substrate 610 and then encased with the underfill material 410 to form a single packaged device. The underfill 410 encasing the dies 401 and 402 includes “a protective material such as an epoxy or ceramic layer . . .” (Venkateshwaran, col. 2, Ins. 57-58.) The dies 401 and 402 are thus “fixedly attached” to each other and are not individually separable without destroying the entire package.

It would also not be obvious to modify Venkateshwaran in accordance with claim 50 such that the die 401 is "not fixedly attached" to die 402. This would require removal of the underfill material 410 from Venkateshwaran's packaged device. Venkateshwaran, however, teaches that stress reduction in the assembly is provided by the underfill 410 that surrounds the bumps 411 and absorbs stresses arising from thermal mismatch in the assembly. As explained above, the underfill 410 includes a thermosetting polymer material to provide "a thermal path to the outside of the package for each integrated circuit." Thus, removing the underfill material 410 from the packaged device of Venkateshwaran would be counter to several of the teachings of this reference. Accordingly, Venkateshwaran cannot support a Section 103 rejection of claim 50 because this reference fails to teach or suggest not fixedly attaching the second packaged device to the first packaged device. Therefore, the rejection of claim 50 should be withdrawn.

Claims 51-55 depend from claim 50. Therefore, the Section 103 rejections of these dependent claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

As discussed previously, independent claims 68 and 73 include several features generally similar to claim 50 (e.g., the second packaged microelectronic device not being fixedly attached to the first packaged microelectronic device.) Accordingly, for the reasons discussed above and for the additional features of these claims, the Section 103 rejection of claims 68 and 73 is unsupported by Venkateshwaran and should be withdrawn.

Claims 70-72 depend from base claim 68, and claims 74, 76, and 77 depend from base claim 73. Therefore, the Section 103 rejections of claims 70-72, 74, 76, and 77 should be withdrawn for the reasons discussed above and for the additional features of these dependent claims.

As discussed above, independent claim 57 includes a first packaged microelectronic device "having a microelectronic die generally encased in a first encapsulant to define a first planform shape," and a second packaged microelectronic

device "having a microelectronic die generally encased in a second encapsulant to define a second planform shape different than the first planform shape." Claim 57 is thus patentable over Venkateshwaran because the applied reference does not teach or suggest a first and a second encapsulant generally encasing a first and a second die, respectively. At best, underfill material 410 in Venkateshwaran's assembly "surrounds the smaller dice [402], contacts the active surface of the larger die [401], and thereby provides a thermal path to the outside of the package for each integrated circuit." (Venkateshwaran, col. 4, Ins. 54-57.) While the underfill 410 "generally encases" the smaller die 402, it only "contacts" one surface of the larger die 401. This is in direct contrast to the teachings of claim 57 where the first and second packaged microelectronic devices are generally encased with a first and a second encapsulant, respectively.

Moreover, it would not have been obvious to use a first and a second encapsulant in the prior art device. In rejecting this claim, the Office Action states that "the 35 U.S.C. § 103 rejection based on a first encapsulant and a second encapsulant deals with an issue (i.e., the integration of multiple pieces into one piece or conversely, using multiple pieces in replacing a single piece) that has been previously decided by the courts." (Office Action, p. 3; emphasis in original.) The Office Action asserts, therefore, that it would have been obvious "to use the first and second encapsulants . . . as 'merely a matter of obvious engineering choice' . . ." (Office Action, p. 6.) This statement, however, mischaracterizes the proper legal standard for a Section 103 analysis.

The MPEP requires that when "determining the differences between the prior art and the claims, the question under 35 U.S.C. § 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious." (MPEP § 2141.02 (*citing Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 U.S.P.Q. 871 (Fed. Cir. 1983))). In the present case, however, the Office Action ignores this legal standard and instead simply focuses on one difference between the claimed invention and the applied references, arguing that the use of a first and a second encapsulant as opposed to a single encapsulant is simply "an obvious

engineering choice.” Instead, the Office Action should have focused on the claimed invention as a whole to determine where the use of two encapsulants is obvious in light of the prior art.

When analyzed using the proper legal standard, claim 57 is patentable over Venkateshwaran under Section 103 because one skilled in the art would not be motivated to use both a first and a second encapsulant as taught by claim 57 in Venkateshwaran’s stacked multi-chip assembly. As discussed previously, the encapsulant in Venkateshwaran reduces both mechanical and thermal stress in the assembly, as well as dissipating heat generated by the assembly’s microelectronic components. It would not have been obvious at the time of the invention to use two encapsulants in Venkateshwaran’s device because it would unnecessarily add to the cost and complexity of the device. For example, if a first encapsulant were used on the lower die 402 and a second encapsulant were used on the upper die 401, it would add at least one additional step to the fabrication process, as well as increasing the cost of materials for the device. Furthermore, the first and second encapsulants would have to be positioned in intimate physical contact with each other in order to obtain the benefits described by Venkateshwaran (i.e., to ensure that the mechanical and/or thermal stresses from the device were mitigated.) One skilled in the art would thus be deterred from modifying Venkateshwaran’s device in light of the claimed invention.

Claims 58-62 depend from claim 57. Therefore, the Section 103 rejections of these dependent claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

E. Response to the Section 103 Rejection of Claims 50-53, 55, 57-60, 62-70, 72, 73, 76, and 77

Claims 50-53, 55, 57-60, 62-70, 72, 73, 76, and 77 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tamaki. For the reasons explained below, however, the Section 103 rejection of these claims is not proper because Tamaki fails to teach or suggest all of the claimed features.

1. Tamaki Discloses a Stacked Semiconductor Device Package Including a Plurality of Dies Attached to a Substrate

Tamaki discloses a stacked semiconductor device package having a pair of stacked dies. Referring to Figure 1, for example, Tamaki discloses a first chip 1 and a second chip 2 mounted on a circuit board 19. "The first and second chips 1 and 2 have rear surfaces adhered to each other by means of an adhesive 15." (Tamaki, col. 10, Ins. 12-13.) The first chip 1 and second chip 2 are electrically connected to the circuit board 19. A first resin 9 is interposed in the gap between the first chip 1 and the circuit board 19. The entire semiconductor device is then covered with a second resin 13.

2. Claims 50-53, 55, 57-60, 62-70, 72, 73, 76, and 77 are Patentable over Tamaki Because this Reference Fails to Teach or Suggest Several Claimed Features

As explained previously, claim 50 teaches that "the second packaged microelectronic device is not fixedly attached to the first packaged microelectronic device." In contrast, Tamaki discloses that the first chip 1 and second chip 2 are adhered together with an adhesive 15. Moreover, there is no teaching or suggestion in Tamaki to modify the stacked semiconductor device such that the first chip 1 is "not fixedly attached" to the second chip 2. Accordingly, Tamaki cannot support a Section 103 rejection of claim 50 because this reference fails to teach or suggest not fixedly attaching the second packaged device to the first packaged device. Therefore, the rejection of claim 50 should be withdrawn.

Claims 51-53 and 55 depend from claim 50. Therefore, the Section 103 rejections of these dependent claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

Independent claims 68 and 73 include several features generally similar to claim 50 (e.g., the second packaged microelectronic device not being fixedly attached to the first packaged microelectronic device.) Accordingly, for the reasons discussed above and for the additional features of these claims, the Section 103 rejection of claims 68 and 73 is unsupported by Tamaki and should be withdrawn.

Claims 69, 70, and 72 depend from base claim 68, and claims 76 and 77 depend from base claim 73. Therefore, the Section 103 rejections of claims 69, 70, 72, 76, and 77 should be withdrawn for the reasons discussed above and for the additional features of these dependent claims.

As discussed previously, independent claim 57 includes a first packaged microelectronic device having a first microelectronic die generally encased in a first encapsulant to define a first planform shape," and a second packaged microelectronic device having a second microelectronic die generally encased in a second encapsulant to define a second planform shape different than the first planform shape. At best, Tamaki discloses a first resin 9 interposed in the gap between the first chip 1 and the circuit board 19. In no way is the first resin 9 "generally encasing" the first chip 1. Furthermore, Tamaki does not teach or suggest modifying the device to include additional quantities of the first resin 9 "encasing" the first chip 1. To the contrary, Tamaki teaches that the second resin 13 "encases" the entire semiconductor device (i.e., both the second chip 2 and the top and side surfaces of the first chip 1). Claim 57 is thus patentable over Tamaki because this reference fails to teach or suggest a first die generally encased in a first encapsulant and a second die generally encased in a second encapsulant. Accordingly, the Section 103 rejection of claim 57 should be withdrawn.

Claims 58-60 and 62 depend from claim 57. Therefore, the Section 103 rejections of these dependent claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

Independent claim 65 includes several features generally similar to those described above with reference to claim 57 (e.g., a first die generally encased in a first encapsulant and a second die generally encased in a second encapsulant). Accordingly, the Section 103 rejection of claim 65 should be withdrawn.

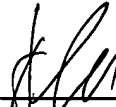
Claims 64, 66, and 67 depend from claim 65. Therefore, the Section 103 rejections of these dependent claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

Conclusion

In view of the foregoing, the pending claims comply with 35 U.S.C. § 112 and are patentable over the applied art. The applicant respectfully requests reconsideration of the application and a mailing of a Notice of Allowance. If the Examiner has any questions or believes a telephone conference would expedite prosecution of this application, the Examiner is encouraged to call the undersigned at (206) 359-3982.

Respectfully submitted,

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Date: 1/3/05

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